Supplementary PSAT Analysis – Contributions on the Cleanest Days
11/7/2008

Conclusions

Analyzing the particulate matter source apportionment (PSAT) data on clean days provides no evidence suggesting county level boundaries are more appropriate than sub-county boundaries. Considering *all* technical data provided to U.S. EPA, the weight of evidence continues to justify small sub-county nonattainment boundaries confined to areas in the vicinity of the violating monitors.

Overview

The magnitudes of the clean-day nitrate concentrations in both counties are trivial (averaging less than or equal to 0.03 $\mu g/m^3$), thus the nitrate results are not particularly meaningful or informative. The sulfate concentrations are larger than nitrate concentrations on clean days, but remain at or below 0.7 $\mu g/m^3$. In contrast to the polluted days, the sulfate boundary conditions are an important source on clean days. Like the polluted days analysis, the PSAT modeling showed local sources are not significant contributors to secondarily formed sulfate and nitrate on the clean days. Overall, the clean days analysis does not impact or alter previous conclusions reached from the polluted days analyses.

Contribution assessments for the 2% lowest particulate sulfate and nitrate concentrations show both similarities to and deviations from the apportionment of these pollutants across the annual average and highest 2% concentrations (discussed in the October 20th, technical support document). Similarities include near zero contributions from sources in Rock Island County, significant percentage contributions from the CONUS source region, comparable contributions from the Iowa and the "Outside Iowa" source regions, and negligible contributions from sources in Scott and Muscatine Counties. The most notable discrepancy is associated with the importance of the sulfate boundary conditions on clean days.

Sulfate Results in Scott County

Figure 1 shows the averaged sulfate apportionment of the 2% lowest sulfate concentrations at the Blackhawk Foundry monitor location. The average sulfate concentration on these clean days was 0.7$\mu g/m^3$, with the majority of the sulfate apportioned primarily to boundary conditions and the CONUS region (which includes the majority of the Continental U.S. plus all regions modeled in Canada and Mexico). The large relative percentage of particulate sulfate contributed by the boundary conditions is a result of the large transport distances possible for sulfates. However, even though this percentage is larger than the annual average contribution from the boundary conditions, the absolute magnitude, shown in Table 1, is roughly the same. In fact, the only sulfate contribution, in absolute magnitude, that is different by more than 0.25 $\mu g/m^3$ between the annual average and average of the 2% lowest sulfate concentrations is from the CONUS source region. As a result, these sulfate concentration increases are almost entirely the result of emissions located in the CONUS source region.

Nitrate Results in Scott County

The interpretation of the nitrate results is limited by the small concentrations modeled on clean days, as percentages based on small numbers are sensitive to slight perturbations. It must be stressed, that while the percentage contributions attributable to a given region discussed here may appear significant, these values are in reference to an extremely small average concentration of only 0.03 $\mu g/m^3$. Only for completeness is a brief discussion of the nitrate results provided.

Figure 2 shows nearly half of the particulate nitrate is apportioned to the CONUS region for the 2% lowest nitrate concentrations. Within the 12 km domain, but outside Iowa, is the next largest contributor to these lowest nitrate concentrations. Again, the absolute concentrations apportioned to the CONUS region were significantly different for the annual average and 2% lowest average nitrate concentrations, while concentrations apportioned to the remaining source regions were similar. As mentioned, these percentages are in reference to an extremely small average concentration of only 0.03 $\mu g/m^3$ and are thus not meaningful.

Results for Muscatine County

Results for the 2% lowest particulate sulfate and nitrate concentrations at the Garfield School monitor location in Muscatine County are similar to the Scott County results. Figure 3 shows 84% of the lowest 2% sulfate concentrations are apportioned to the boundary conditions and the CONUS region. The remaining five source groups split the remainder of the apportioned sulfates. Figure 4 shows more than half of the nitrate concentrations are attributed to emissions in the CONUS source region, while nearly 25% originate from Iowa. The remaining 20% of the nitrate contributions are split between the remaining source groups. As in Scott County, although the percentage values may be significant, they are based upon an extremely small average nitrate concentration of 0.002 $\mu g/m^3$, and thus do not provide useful information regarding proper nonattainment boundary placement.

Summary

Considering the low concentrations, and relative uncertainties increase with decreasing magnitude, these apportionment results are limited and should be interpreted with caution. As mentioned, the clean days analysis does not impact or alter previous conclusions reached from the polluted days analyses. Considering all technical data provided to date the weight of evidence continues to justify small sub-county nonattainment boundaries confined to areas in the vicinity of the violating monitors.

Table 1. Apportioned Particulate Nitrate and Sulfate Concentrations for the Annual Average and 2% Lowest Average Concentrations at the Blackhawk Foundry Monitor.

	BC	CONUS	Outside IA	Iowa	Muscatine Co.	Scott Co.	Rock Island Co.	Total
2% Lowest								
PSO4	0.3	0.3	0.02	0.06	0.03	0.04	0.003	0.7
PNO3	0.001	0.01	0.004	0.004	0.003	0.003	0.001	0.03
Annual Avg								
PSO4	0.4	2.6	0.2	0.3	0.1	0.1	0.04	3.8
PNO3	0.2	2.8	0.6	0.7	0.05	0.3	0.08	4.6

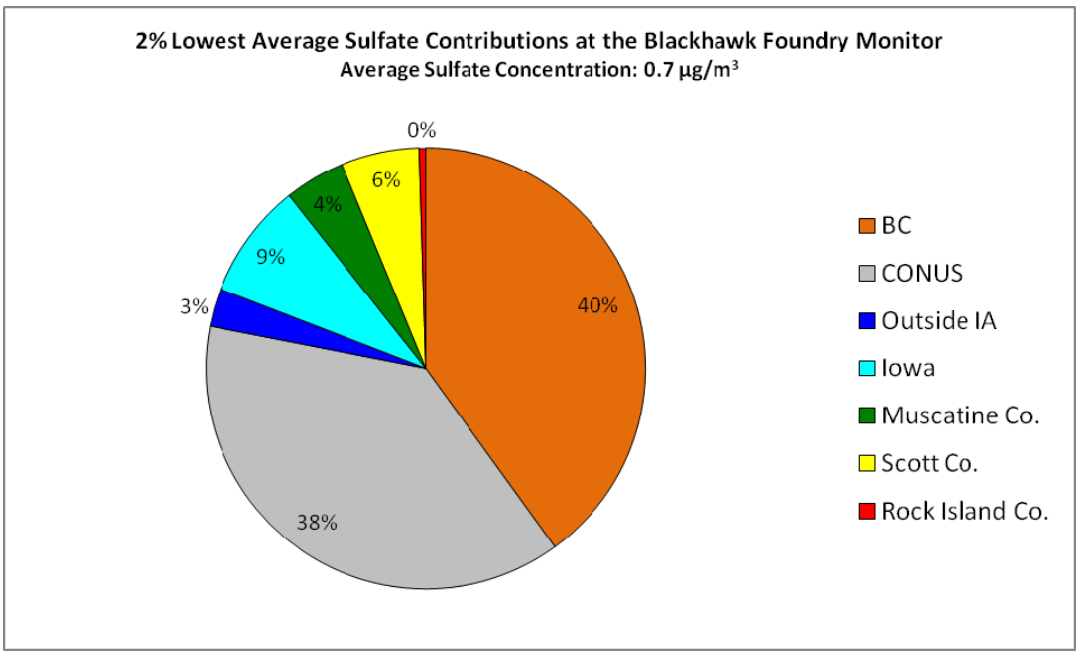

Figure 1. Average sulfate contributions by source region at the Blackhawk Foundry monitor for the 2% lowest sulfate concentrations.

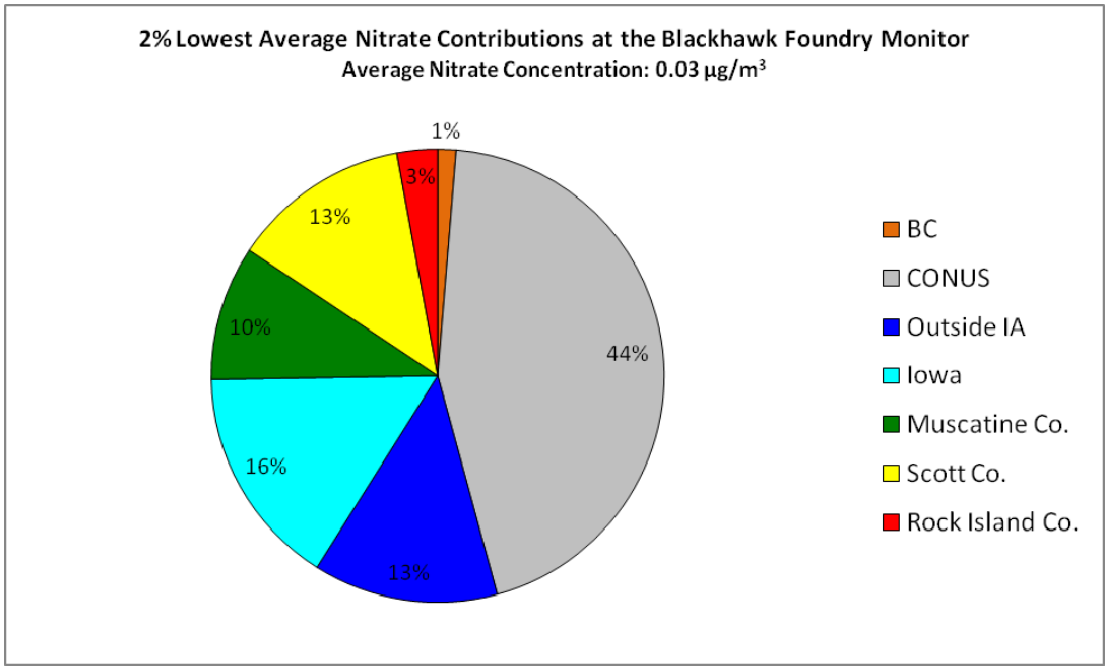

Figure 2. Average nitrate contributions by source region at the Blackhawk Foundry monitor for the 2% lowest nitrate concentrations.

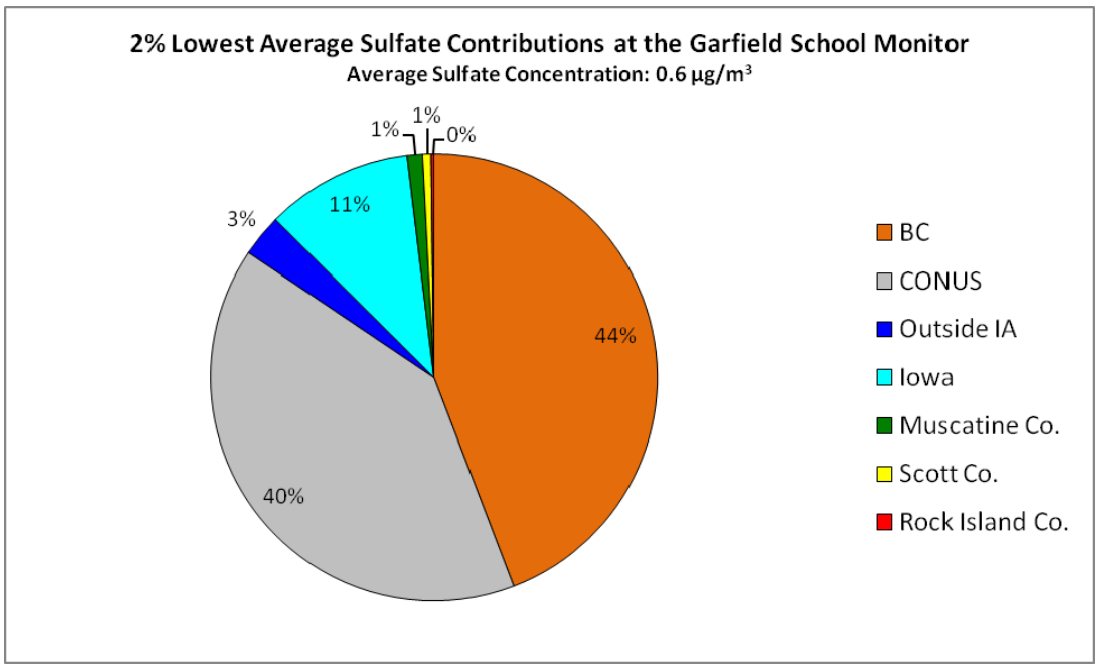

Figure 3. Average sulfate contributions by source region at the Garfield School monitor for the 2% lowest sulfate concentrations.

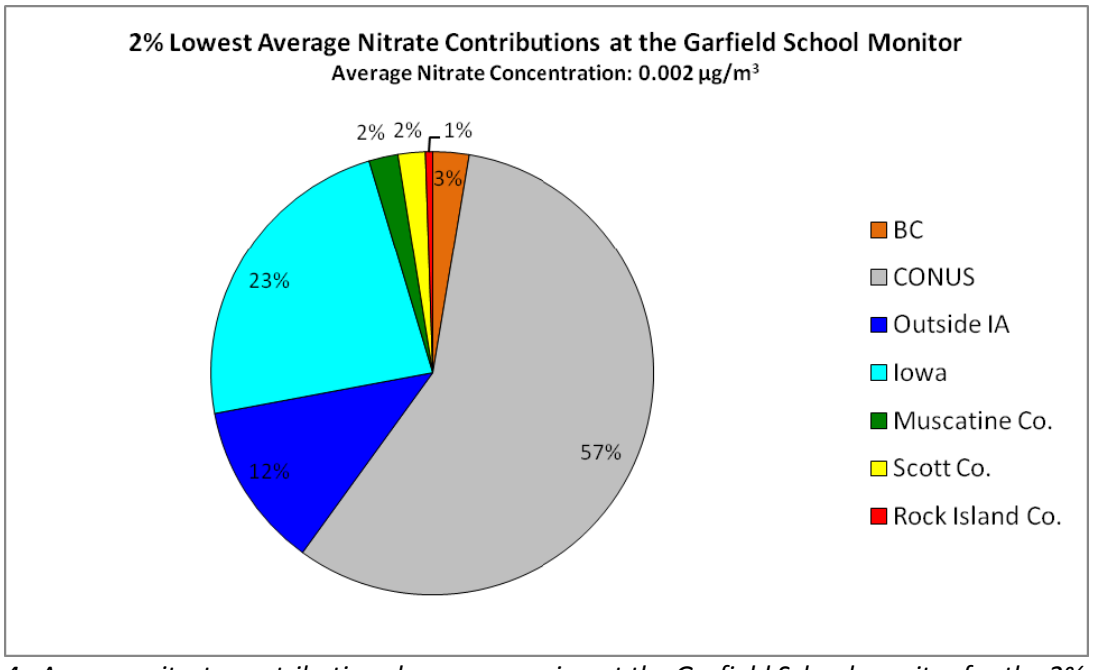

Figure 4. Average nitrate contributions by source region at the Garfield School monitor for the 2% lowest nitrate concentrations.